UNITED STATES PATENT APPLICTION

OF

JOSEPH J FRANZINO

&

RON JERMAN

FOR

APPARATUS & METHOD FOR CLEANING COOLING TOWER RECIRCULATING WATER

BACKGROUND OF THE INVENTION

The present invention is directed to cooling towers and particularly to an apparatus and method for removing water and debris from a cooling tower basin, discarding debris and returning clean water to the basin.

Cooling towers are a component of commercial and industrial heat transfer equipment including for example chillers, coolers, and air conditioning systems. A cooling tower transfers heat from such equipment to ambiance. In a cooling tower, heat is removed from recirculating cooling water by cascading the water over baffles and by drawing a countercurrent of ambient air through the baffles so as to cool the cascading water. Air so heated is exhausted to atmosphere and the cooled recirculating water is collected in a basin situated in the tower under the baffles. The cooling tower basin being exposed to the atmosphere accumulates sediment including airborne dirt, dust, organic matter and so forth that contaminates the water and consequently fouls heat exchange tubes in a heat transfer system.

There are systems for cleaning cooling tower basins such as U.S. Pat. No. 4839064 directed to the use of an installation of a siphon and filter together with a portable tool for cleaning one or multiple basins, or a permanent installation including a basin tool for one or more towers. According to the patent disclosure, water and debris are siphoned from a cooling tower

and discharged to sewer through a filter. In a modified apparatus for an above-grade siphon, a pump within a hermetically sealed receiver establishes and maintains a siphon from basin through a filter to discharge. For operation of the modified apparatus of the patent, the system is primed between basin and receiver, and the pump is operated to draw water and sediment from the basin for discharge through a filter. The '064 patent requires a permanent installation of components such as receiver and pump unit, or is limited to slow and uncertain action of continuous siphon action for cleaning a basin.

U.S. Pat. No. 4306967 discloses a trailer mounted cleaning apparatus for cleaning cooling tower water including a diesel engine driven pump, a filter device, a bank of hydrocyclone separators, and a sediment collecting tank. Clarified effluent from a cooling tower basin is recirculated back to the cooling tower basin, and sediment is collected in the tank for later removal by means of an auger fitted into the tank.

There is need for a conveniently deployed and operationally efficient method and apparatus for cleaning cooling tower basins.

The present invention is directed to an apparatus and method for removing contaminating debris from cooling tower basins.

SUMMARY OF THE INVENTION

In accordance with the present invention, a cooling tower recirculating water cleaning apparatus comprises an integrated portable machine including a mounting carriage, a debris collecting tool, a strainer, a motor driven self-priming centrifugal pump, and a discharge line to drain. The apparatus cleans the cooling tower basin by placing the debris collecting tool into the basin, priming the pump, and operating the pump to withdraw water and debris from the basin, straining the water and debris upstream of the pump, and discharging water and entrained debris to a sewer. In preparation for cleaning the basin, make-up water is added to the basin to allow for removal of approximately 20-25% of basin water in a cleaning operation. Thereafter, the basin debris is undisturbed allowing it to settle to the bottom of the basin for 24-48 hours before cleaning. For actual cleaning the collecting tool is placed in the basin water to collect and remove debris as the centrifugal pump removes and discards debris laden water.

In a modified embodiment of the apparatus of the invention, water and debris drawn from a cooling tower basin is filtered during a cleaning operation, and filtered water is returned to the basin.

Specific examples are included in the following description for purposes of clarity, but various details can be changed

within the scope of the present invention.

OBJECTS OF THE INVENTION

An object of the invention is to provide an apparatus and method for removing sediment and debris from a cooling tower basin.

Another object of the invention is to provide a mobile apparatus for quickly, conveniently and routinely cleaning cooling tower water of sediment and debris so that recirculating cooling tower water is maintained in a clean condition thereby avoiding fouling heat exchanger tubes.

Another object of the invention is to provide apparatus for quickly, conveniently and routinely cleaning a cooling tower water basin of sediment and debris and returning filtered water to the basin.

Other and further objects of the invention will become apparent with an understanding of the following detailed description of the invention or upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for detailed description to enable those having ordinary skill in the art to which the invention appertains to readily understand how to construct and use the invention and is shown in the accompanying drawing in which:

Figure 1 is perspective view of an apparatus for cleaning cooling tower water according to the invention.

Figure 2 is a side elevation view of interior components of the apparatus of Figure 1.

Figure 3 is a view of the apparatus in position for cleaning a cooling tower in practice of the invention.

Figure 4 is a perspective view of a tool for engaging and vacuum gathering water and sediment in a cooling tower basin.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, the apparatus 10 for cleaning cooling tower water according to the invention comprises a carriage 12 having a supporting base 12a fabricated of robust material such as steel or aluminum for mounting the operating components of the apparatus, a set of wheels 14 affixed to one end 12b of the base for wheeling the apparatus into position beside a cooling tower, an extensible handle 16 projecting from the other end 12d of the base, and a stand 18 depending from the other end of the base for level positioning of the apparatus for cleaning a cooling tower basin and recirculating water.

The apparatus further includes an outer housing 20 mounted along the perimeter of the base in covering relation to the operating components and comprising upstanding front 20a, rear 20b, left 20c and right 20d side walls, and a top cover wall 20e

in three sections of upper 20f, vertical 20g, and lower 20h top wall portions. The left and right side walls include lower vertical 20i and upper inclined 20j sections. The outer housing is formed of robust material such as stainless steel or aluminum, and has ventilation slots or louvers 20k for admitting ambient cooling air to the interior operating components of the apparatus.

As shown in Figure 2, the operating components of the apparatus assembled on the mounting carriage base 12a comprise a strainer 22 within a strainer housing 24, a drive motor 26, a centrifugal pump 28, and a discharge line 30 to drain.

The mounting base 12a is a robust aluminum plate with planar surface of sufficient strength to carry the operating components and to withstand torsion and other forces generated in operation of the apparatus. A pair of semi-pneumatic supporting wheels 14 connected by an axle 14a support one end 12b of the base and provide for close positioning of the apparatus at a cooling tower basin (Fig. 3) enabling an operator to manipulate vacuum hoses and tools as desired for cleaning the basin.

An electric drive motor 26 is positioned at the one end of the mounting base between the wheels and is bolted to the base plate. A pump-mounting cage 27 is bolted to the front face 26a of the drive motor and the cage in turn receives centrifugal

pump 28 bolted to the cage with the pump shaft 28a in axial alignment with and connected to the motor drive shaft 26a. The result is integral mounting of motor and pump affixed to each other and with only the electric motor affixed to the mounting base. The electric motor is preferably one and one-half horsepower and either 115v or 230v with an on/off operating switch 26b. The centrifugal pump is preferably of 60gpm capacity with discharge overpressure of approximately 39psi and an inlet underpressure of approximately 11psi.

The centrifugal pump 28 includes an axial inlet manifold 28b and a tangential outlet manifold 28c for drawing fluid to the inlet at a negative 11psi and discharging at positive 39psi at the outlet.

A lightweight strainer housing 24 has an integral outlet connection 24d that is affixed to and supported in operating position by the pump inlet manifold 28d. The strainer housing is preferably fabricated of molded plastic with imperforate outer wall 24a projecting through an opening 12e in the mounting base, a fluid inlet connection 24b, an outlet connection 24d, an interior chamber 24e for receiving a perforated fluid strainer, and a removable top cover 24f for periodically removing and cleaning the strainer. Interior baffles (not shown) in the strainer housing direct inlet water through the strainer before

entering the pump inlet manifold. The strainer 22 is preferably fabricated of aluminum with three-sixteenth inch perforations.

A discharge pipe 30 is connected to the pump discharge manifold 28c and extends underneath the upper top wall 20f through the rear housing wall 20b and terminates in a discharge connection 30a which receives a drain hose 31 (Fig 3). A discharge valve 32 is fitted to the discharge pipe with valve stem 32a extending through the upper wall 20f and a stop valve handle 32b accessible outside the upper wall. The front end 30b of the discharge pipe is fitted with a priming water hose connection 34 and priming water valve 36 for regulating water flow through this connection. As more fully described below, a water hose 38 connected to the discharge pipe with closed discharge valve and open priming valve provides for initial priming of the centrifugal pump prior to cleaning a tower basin.

It is to be understood that the apparatus of the present invention especially as seen in Figure 2 comprises a robust, compact maneuverable assembly in which an integral unit comprising motor, pump, strainer housing, and discharge pipe are affixed to each other with only the motor housing affixed to the mounting base, and with heavy components including drive motor, mounting cage, centrifugal pump and discharge pipe positioned from midpoint 12c to the one end 12b of the mounting base ensuring that the wheeled end of the unit bears a major portion

of unit weight both at rest and while in motion. The entire apparatus weighs on the order of one hundred twenty-five pounds and is provided with a handle 16 that is extended (Fig 2) for added leverage in tilting the carriage to "wheel around" position and retracted (Fig 3) for compact storage when the unit is stationed at a cooling tower for cleaning operations.

As shown in Figure 4, the apparatus includes a basin tool 40 through which water and sediment are drawn by the centrifugal pump. The tool is fitted to the far end 42a (Fig 4) of an inlet hose 42 that extends from the basin B for connection at its near end 42b to the strainer housing inlet 24b (Fig 3). The inlet hose is provided with an inlet control valve 44 allowing an operator to open and close the inlet hose as desired during a cleaning operation.

The tool 40 is a hollow shell with a tubular portion 40a for connection to the inlet hose 42, and an integral head 40b with walls in the general form of a prism. The tool head walls define a depending skirt 40c with a generally rectangular perimeter edge 40d having spaced rectangular notches 40e defining a plurality of portals for passage of water and sediment from a cooling tower basin into the tool head when the centrifugal pump is in operation pulling negative 11psi through the tool.

To prepare for cleaning a cooling tower basin, make-up water of about 20-25% of tower capacity is added to the system. The cooling tower is then shut down for a 24-hour period allowing sediment to settle in the cooling tower basin. The apparatus of the present invention is wheeled into position next to the basin with the tool head placed in the basin. The centrifugal pump is primed when the system is filled with water between the discharge valve and the tool head situated in the basin. Priming is accomplished by closing the discharge valve, opening the prime water inlet valve, connecting the inlet hose at its near end to strainer inlet with basin tool at the far end submerged in basin water, opening the inlet hose valve, and flooding the system between discharge valve and basin tool with tap water supplied through the prime water valve by a utility hose.

For operating the unit to evacuate the basin and clean the cooling tower water, the motor switch is turned on to start pumping, the discharge valve is immediately opened and the prime valve is closed. Water and sediment pumped from a basin may be discharged to a sewer or may be filtered and clean water returned to the basin. When an operation is complete, the strainer is removed, cleaned and replaced and the unit flushed with clean water.

In a modified form of the invention, a self-priming centrifugal pump may be used.

Various changes may be made to the structure embodying the principles of the invention. The foregoing embodiments are set forth in an illustrative and not in a limiting sense. The scope of the invention is defined by the claims appended hereto.